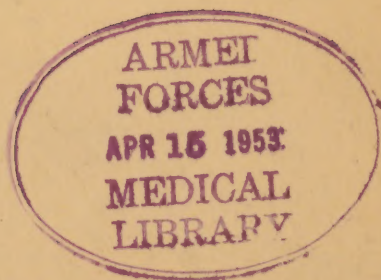


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TUBERCULOSIS  
IN RELATION TO  
Animal Industry and Public Health.

—BY—

JAMES LAW.



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## TUBERCULOSIS IN RELATION TO ANIMAL INDUSTRY AND PUBLIC HEALTH.

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### ITS PREVALENCE AND RELATIVE IMPORTANCE.

Tuberculosis is so extensively prevalent and proves such a veritable scourge throughout the civilized world that no disease is so deserving of close and accurate study, or of the enforcement of effective measures for its suppression. Cholera, yellow fever and small pox, which occasionally invade our territory, creating universal terror and dismay, claim but few victims as compared with this ever-present, universally devastating plague. These other plagues are quick, severe and fatal, it is true, but for this very reason they can be promptly recognized, and checked and even stamped out, whereas tuberculosis is equivocal and underhand in its method, slow and uncertain in its progress, and on this account escapes recognition and proves by far the most deadly of any single disease attacking the human family. The average ratio of deaths from tuberculosis to the total mortality is 14 per cent., or one death in every eight, while under special conditions it rises to one in three, as in the Marquesas Islands, or even one in two, as in some of our Indian reservations. Tuberculosis may be classed with "the pestilence that walketh in darkness," while the three other diseases named are like "the destruction that wasteth at noonday." But the deaths from tuberculosis being constant and uniform, people accept them as inevitable and fold their idle hands with true Mohamedan fatalism instead of boldly exposing the hidden deathtrap, and cutting short its destructive work.

If the 5,490 deaths from tuberculosis which occur every year in the city of New York could be brought together in an epidemic lasting but one week, no small pox, cholera nor yellow fever scare would approach the panic which would thus be created, for

when did all three diseases together create such mortality in this city? Nay, if we take the whole civilized world and compare with the tuberculosis mortality, all the accumulated deaths from war, famine, plague, cholera, yellow fever and small pox we find that the latter are comparatively very insignificant. Yet tuberculosis like every germ disease is absolutely preventible, and is allowed to continue its career of death only because of reprehensible ignorance and criminal indifference.

#### ITS PREVALENCE IN THE LOWER ANIMALS.

Few if any diseases maintain a sway over a more numerous genera of animals than tuberculosis. Among the domesticated animals cattle are perhaps the most susceptible, but chickens, guineapigs, rabbits, swine and goats become victims almost if not quite as easily. Some have thought that dogs, cats, sheep and horses are exempt, but when inoculated with tuberculous material these all contract the affection readily enough. The fact that they do not contract it in such numbers in the usual way is probably due in part to the greater amount of outdoor life which they enjoy, also to the fact that they have more exercise which secures for them a better developed and higher conditioned muscular system, and a full stock of constitutional vigor. After making all these allowances, however, it must be granted that these four classes of animals enjoy a native intolerance to this disease to which the first six classes mentioned are comparative strangers.

Among the less domesticated animals which contract tuberculosis may be named caged apes, lions, kangaroos, deer, elk, gazelle, antelope, birds, and in addition the rats, mice and other vermin of our houses and barns. All must, therefore, be considered as possible bearers and disseminators of the infection and no such animal (indeed, scarcely any animal) can be left out of account in any systematic attempt to root out the disease. Some, however, are justly held to contribute more than others to the maintenance of the affection, and in this sense, in addition to man himself, we must consider as preëminently bearers of this disease cattle, fowls and pigs.

Accurate statistics are wanting to give the rates of tuberculous animals in our herds, as we have no systematic professional



inspection of live animals and of those killed for human food. Even in the large cities of Europe when such inspections are obligatory, in the case of carcasses, the data given are so variable as to suggest the acceptance of different standards in the various cities and countries. Thus tuberculous cattle are said to number: In Bavaria 0.225 per cent. (Goring), in Augsburg 0.26 per cent. (Adam), in Baden 0.2 per cent. (Lydtin), in France 0.5 per cent. (Arloing), in Belgium 0.4 per cent. (Van Hertsen), in Paris 6 per cent. (Friedberger and Fröhner), in Holland 20 per cent. (Schmidt), in Pommerania and Bomberg 50 per cent. (Schanz, Albrecht), at Hildesheim, Hanover, 60 to 70 per cent. (Haarstick), in Leipzig 20 per cent. (Rieck), in Edinburgh 26 per cent. (Cope, McFadyean). American figures given by the Bureau of Animal Industry are for Baltimore (mostly cows) 2.5 to 3.5 per cent. and for the packing centers (among 2,273,547 mostly steers) 0.02 per cent. It must be noted that the data from Baltimore is somewhat too favorable for city cows, as the cows were largely from infected dairies, where the more rapidly fatal lung plague carried off many before time had been allowed for the development of tuberculosis, and as the vacancies were speedily filled by fresh cows from country districts, the results give the ratio for country herds rather than the normal proportion for the city. The splendid showing for the steers must also be qualified by the remark that the fat and apparently healthy are alone sent to the large distant market while the unthrifty are held back lest they should spoil the sale.

Steers further largely escape on account of their out-door life with less opportunity for infection, and because they are, as a rule, killed at three years old and under, and tuberculosis becomes more and more prevalent with the advancing age of the stock. In a large aggregate number of German abattoirs, cows suffered in ratio of 6.9 per cent., oxen 3.6 per cent., bulls 2.6 per cent., and calves and yearlings 1 per cent. In Leipzig, tuberculous cows were 26 per cent., oxen 19.5 per cent., bulls 15.4 per cent., and calves 9.3 per cent.

In infected breeding and dairy herds in New York, consisting largely of mature cows I have found a maximum of 98 per cent. and a minimum of 5 per cent. Again in healthy country districts I have found hundreds of cows in adjoining herds without a trace of tuberculosis among them.

## TUBERCULOSIS CONTAGIOUS.

In the middle ages tuberculosis in animals was recognized as contagious and laws were made against the use of the affected carcasses as human food, which remain in force in Italy and Spain to the present day. In the 16th century the disease was confounded with syphilis and at the end of the 18th century with glanders, blunders which, however untenable, show the strong conviction that the malady was contagious. The propagation by contagion in herd was recorded in Germany by Ruhling (1774), and Krunitz (1787), and more recently by Spinola, Zannger and others. In France the same is claimed by Fromage, Huzard, Lafosse, Dupont, and Cruzel.

It must be allowed, however, that in the first half of the present century, the manifest tendency of the disease to run in families, and to develop under special unwholesome conditions of life, served to weaken the belief in contagion, and in Central and Western Europe such belief had become practically extinct among medical men, when their attention was recalled to the subject by the successful inoculations of tuberculosis on rabbits and guinea-pigs, by Villemin, in 1865. The subject was taken up on all sides by incredulous experimenters and for a time a keen polemic warfare raged, but slowly the stern logic of constantly accumulating and unanswerable facts compelled all candid observers to accept the doctrine of contagion.

## THE GERM. BACILLUS TUBERCULOSIS.

An even fuller demonstration came in 1882, when Robert Koch, of Berlin, demonstrated the existence of the tubercle bacillus, and showed that the disease could be produced with equal certainty by inoculating with the substance of a tubercle from the ox's lung, or with a pure culture of the germ grown on peptonized gelatine, apart from the living body. Before publishing his discovery Koch demonstrated the presence of the bacillus in the expectoration or tubercle of over 100 cases of consumption, and had successfully inoculated 472 subjects—guineapigs, rabbits, mice, rats, and cats, besides dogs, pigeons and chickens. The following are some of the characteristics of this germ :

*Form.*—A delicate rod with rounded ends, 1.5 to 3.5 micromillimeter in length (about 1-2500th of an inch). They occur singly, or in pairs or chains



of three or four connected end to end. When cultivated on blood-serum the groups tend to form elongated rope-like colonies, having a waving or serpentine outline.

*Staining.*—It is characteristic of this bacillus that it absorbs coloring matters very slowly and once stained retains its color with great tenacity. This enables the microscopist to distinguish this amid a mass of other microbes. The opaque particles in sputum or a section of the tubercle is stained by prolonged exposure to a warm alkaline solution of an aniline pigment; it is then bleached by a solution of nitric acid (1:3); it is then washed and slightly stained with a color which will contrast with the first; finally it is washed, mounted and examined under the microscope. The rod-like bacillus tuberculosis appears stained with the first color while the other bacteria, if any, are stained with the second.

*Biology, Life-history.*—The bacillus tuberculosis lives mainly as a parasite in the animal body, but may be cultivated on the ordinary culture media containing 5 per cent. of glycerine and makes the best growth at 100° to 102° Fah. A temperature of 158° Fah. for ten minutes is fatal to it (Yersin). Unlike many bacilli this shows no spontaneous movement at any stage of its growth. Its development is slow in any medium, the earliest signs of growth being visible only after ten or fourteen days.

*Vitality.*—As it has great power of resistance to the entrance of coloring fluids, so this germ can hold its own for a length of time against destructive agencies. It retains its vitality and infecting power for nine to ten months in dried expectoration (Koch, Schill, Fischer, De Thoma). In tuberculous cow's lung, dried and pulverized, it infected Guinea pigs after 102 days. In putrid matter it infected after 43 days (Schill, Fischer) or 102 days (Cadeac, Malet). It is not destroyed by gastric juice (Baumgarten, Fischer, Falk).

In sputum it perishes in 20 hours in a 3 per cent. solution of carbolic acid in a saturated aqueous solution of salicylic acid or in saturated aniline water (Schill, Fischer); in five minutes by iodoform ether; in ten minutes in sulphuric ether or mercuric chloride (1:1000); in three hours in thymol. It dies in a few hours in direct sunlight, and in five to seven days in diffuse daylight (Koch). In an ordinary room it gradually weakens but remains virulent for at least 2½ months (Sawiskey).

While none of such accessory causes can generate tuberculosis in the absence of the bacillus, yet when that diseased seed is present, these conditions often serve to sway the balance toward its advancement and diffusion, or its restriction and suppression. A suitable soil and favorable climate is no less essential for the vigorous growth of the microscopic vegetable microbe, than for the Florida moss or the palm.

Among the most efficient accessory causes may be named :

*a. Hereditary Predisposition.*

Consumption runs in families and it has long been supposed that this was essentially a family—that is, a hereditary disease. But as a matter of fact it is extremely rare to find the offspring tuberculous at birth or before. In many thousands of pregnant tuberculous cows killed in the slaughter-houses of Europe not more than ten tuberculous calves have been found. To the same effect is the fact that in calves under a year old, born of cows, six per cent. and upwards of which prove tuberculous, the ratio of tuberculosis is often below one per thousand. In Saxony with the ratio of tuberculous cattle 16.5 per cent. that of tuberculous calves was only 2 per 1000. At Lyons out of 400,000 calves slaughtered only 5 were found tuberculous and at Munich out of 400,000 but 2 tuberculous. Again in such calves the tubercle is found in a very large proportion of cases in the bowels and adjacent glands suggesting infection after birth through the milk, rather than in the liver and lungs which would have been its natural seat if conveyed before birth through the blood. Not a few of the obstinate and fatal bowel diseases of sucking children and calves are in reality tuberculosis of the bowels induced by the infected milk.

What runs in a family then is rarely hereditary disease:—it is in the great majority of cases only a hereditary susceptibility to the disease, tuberculosis. But it is none the less a fearful legacy, being often so potent that the disease attacks certain families as a matter of course, while other families can count on a practical immunity. In the human family this is notorious. In cattle it is no less remarkable. In the Burden herd of Jerseys in 1877, I made examinations, and condemned eleven animals, verifying my diagnoses by examinations after death, and found to my

surprise that I had taken every representative of a given family, and left the pure bred members of the second family untouched. Both families had mingled freely in the pastures and yards, yet the second family furnished no tuberculous cases and remained sound from that time onward.

*b. Close Buildings, Lack of Ventilation.*

Air rendered impure by repeated breathing is so favorable to the propagation of tuberculosis that it has been looked upon as the sole cause (Macormac). Though now certain that this cannot produce tuberculosis at all in the absence of the germ, yet it is such a potent accessory cause when the bacillus also is present, that its importance cannot be too highly appreciated.

For the mild cases of tuberculosis in man life in the open air, day and night, in a genial climate with pure air affords one of the best grounds of hope of recovery or mitigation. In the Burden herd above referred to, animals condemned in the spring spent the summer at pasture, with a general appearance of perfect health, yet, when returned to the barns in the fall, they fell off so that soon some of them had to be helped to rise in the stall. All the world over city dairy cows are notorious for tuberculosis. In Europe where the country cattle are affected in a ratio of 1 to 2 per cent., those in the city dairies suffer to the extent of 6 to 20 per cent. and upward. Of our plains and prairie steers the government inspectors, at the abattoirs, condemned as tuberculous but 0.02 per cent., whereas of the city dairy cows, mostly recently from the country, they condemned 1.23 per cent. The ratio is 1 steer to 60 cows, a most striking showing in favor of an open air life.

*c. Dark Stables.*

Dark stables are usually dirty and ill-ventilated, and as such, lower the general health of the inmates and strongly predispose them to tuberculosis. The darkness, however, acts indirectly in depriving the tissues of the body of their due supply of air. The formation of green pigment (chlorophyll) in plants, and that of red pigment in the blood globules are alike due to the action of light. In darkness both disappear. But the red globules of the blood are the bearers of oxygen to all parts of the body, and if these globules are deficient the whole body is denied its due



aeration. The final result is as if the air contained little oxygen, in other words, as in the case of a close building without any means of renewing the air.

*d. Insufficient or Unwholesome Food. Overtaxing.*

Lack of food, and indigestible, or innutritious food, agree in producing practical starvation and weakness with increased susceptibility to tuberculosis. Hence, this disease is the scourge of the half starved poor, and no less of the rich who abuse their digestive organs, and court chronic dyspepsia. So, too, in our dairy herds the stimulating ration-for-milk, the warm drinking water, and warm atmosphere, together with the enforced rest in the stalls for months at a time, and the clean, careful milking soliciting the gland to act to its extreme capacity, all tend to a lowering of the general health and an increased susceptibility. This sufficiently illustrates how the cow which has been made a milking machine, and which to this end must produce a calf every year, becomes dangerously susceptible to any tubercle bacillus to which it may be exposed. We have developed most valuable qualities at the expense of hardihood, and we must take the consequence. The argument is not that we should part with acquired powers which give the animal its high value, but that we should recognize the attendant dangers and rigorously exclude the tubercle germ.

*e. Breeding too Young.*

Breeding of immature animals is a most fruitful accessory cause of tuberculosis as the demands made upon the system for further growth, for the nourishment of the unborn offspring, and later for the nursing of the calf, or for the dairy yield, undermine the strength and vigor. In different families of that marvelous dairy cow, the Jersey, this has been carried to such an extent that discredit has been thrown upon the whole breed as one especially prone to tuberculosis.

*f. Inbreeding. High-breeding.*

Inbred families of cattle are proverbially subject to tuberculosis. This is due partly to a resulting constitutional weakness, which often shows itself in an increasing indisposition to breed to near relatives, though still fertile with strangers. More frequent-

ly, it depends on the intensifying and fixing of personal and family characters. The susceptibility to the germ being equally strong in both parents becomes intensified in their common offspring just as the beef or dairy characteristics are improved. Indeed, the qualities which make an animal valuable for the butcher or milkman are exactly such as favor tuberculosis. The germ of this disease lives by preference in the lymphatic system, either in the lymphatic glands or in the loose connective tissue forming the lymphatic networks leading to these glands. Now the breeds which are preëminent for early maturity, and rapid fattening, or for a high yield of milk are remarkable for their excess of connective tissue, as shown by the delicate mellow skin, and in the case of the Channel Island cattle by the unusually large lymphatic glands. This helps to explain why certain families of beef-making cattle have been virtually ruined by tuberculosis. Yet it would be equally wrong to abandon the improvement of our beef and of our milking breeds. The improvement already attained is essential to successful competition in the market, and prospective improvement will be no less essential in the future. The true and only real remedy is the extinction and exclusion of the bacillus of tubercle.

*g. Ill Health.*

All acute and chronic diseases leave the system weak, and with less power of resistance to other diseases. Above all we must fear long standing diseases which produce emaciation and weakness, fevers which interfere permanently with the blood-forming processes, diseases of the digestive organs, which hinder the requisite preparation and absorption of nutritive elements, and diseases of the lungs which form a raw or weakened surface on which the bacillus can grow without hindrance. Again the germ lives best in a slightly alkaline or neutral medium, and is weakened in the acid contents of the stomach during vigorous digestion. But in indigestion the contents may be too much lacking in acidity to prove hurtful to the germ, and the imperfectly digested morsels, enclosing the bacillus, may be passed on unchanged into the alkaline intestine, a field especially favorable to the development of tuberculosis. Again in the intervals between meals when the acid secretion is arrested, the bacillus in drinking

water may easily pass through the sentinel stomach to develop in the intestines.

#### *h. Chemical Poisons in the Tuberculous Body.*

The soluble chemical poisons in meat and milk of consumptives will be noticed later as a potent cause alike of susceptibility to tuberculosis and of its more rapid progress when already in the system.

#### LESIONS AND SYMPTOMS OF TUBERCULOSIS.

Tuberculosis appears under two great types: the acute and the chronic, the first of which may run a fatal course of four to six weeks, while the second may last for many years. At the outset in the acute form, and for a great length of time in the chronic, the disease-process may be confined to one organ or to one region of the body and therefore the symptoms may vary exceedingly according to the particular organ attacked. In many chronic cases, with the tubercles confined to one organ or locality (lymphatic glands, liver, spleen, pancreas, etc.) the victim may be in good condition and no sign of disease may be recognized by the owner or even the veterinarian. In acute cases on the other hand and when the tubercles are generally diffused through the body, there is usually fever, wasting and emaciation in addition to the characteristic symptoms of disease in particular organs.

The lesions being caused by the colonization and local multiplication of the bacillus they tend to assume a rounded or nodular form, from which has been derived the name of tubercle. Such nodules may, however, be absent, the diseased product, being a diffuse infiltration and thickening of the affected part. The early nodule may vary in size from a millet seed up to a pea or more. It is at first red, congested and firm; soon it may become gray in the center though still red outside. With the grayish discoloration comes a gradually extending death of the mass (coagulation necrosis) and disintegration into a more or less soft cheesy looking material (caseation). In cattle and chickens this cheesy nodule tends to remain firm and it may even become gritty through impregnation with earthy salts (calcification). Exceptionally it will soften into a semi-liquid whitish debris, resembling an abscess, and this excessive softening is the usual course of tubercle in swine. In some cases however the tubercle does not break down



into a dead cheesy mass but develops into firm fibrous rounded nodules hanging in clusters from the lungs, inside of the ribs, or skin, and known as pearl disease (*perl-knoten*), grapes, etc. This form is particularly common in cattle. In man may be found nearly all forms of the disease, the primary hard red congested nodule, the same with its grayish disintegrating centre, the firm caseated mass, the same further softened into a white or yellowish semi-liquid pus-like mass, and in addition an open unhealthy sore caused by the breaking down of the tuberculous growth on the skin (*lupus*), or intestine, etc. Similar tuberculous sores are found on the skin or mucous membrane (bowels, throat) of cattle and other animals. In all the many forms and seats of the disease the bacillus may be found in the affected parts, and the morbid discharges from the lungs, skin, open sores, etc.

#### SYMPTOMS IN CATTLE.

*a. Tuberculosis of the lungs.*—In the chronic cases which are by far the most common this may last for months and years unperceived; in acute cases it may prove fatal in a month.

In recent, slight, chronic cases there may be no other ground of suspicion than an occasional cough when the animal leaves the hot stable for the cold outer air, when it is suddenly raised in the stall, when it is run for a short distance, when it drinks cold water or eats dusty food. The cough is usually small, dry, wheezing, and may be repeated several times. When run or driven rapidly the animal proves short winded. Yet it may show as good spirits, as clear, full an eye, as smooth glossy a coat, as supple and mellow a skin, as good an appetite, as rich and abundant a flow of milk, and as much propensity to fatten as its healthy fellows. An accomplished diagnostician may detect altered sounds on percussion and auscultation of the chest, but from the difficulty introduced by the heavy muscular shoulder, the frequent variations in the size of the heart, the rumbling and crepitating sounds from stomach and bowels, which, according as they are full or empty, press forward and diminish the size of the lungs, and greatly mask or modify the results, even the able practitioner cannot be trusted to detect these, and the case fails to be recognized. There may be a flow from the nose in which bacilli should be detected by the microscope, but cattle have a habit of cleaning

the nose with the pointed tongue, so that the virulent particles are difficult to secure, and when secured they prove to contain few bacilli so that a failure to find these would not be so reassuring as it would be in man. As a large proportion of cases of chronic tuberculosis of the lungs are of this kind the tuberculin test, to be noted below becomes practically indispensable.

When the lungs become more extensively involved symptoms are more distinct and reliable, and the animal usually falls off in condition, yet in many cases cattle in good condition are killed for beef and the lungs and ribs are found to be literally covered with clusters of fibrous tubercles (grapes). Usually in advanced cases the hair is dry, lustreless, and erect in patches, especially along the back. The skin is dry, powdery, and rigid without its customary mellow touch or mobility on the parts beneath. The eye is less prominent and brilliant, the breathing is more easily accelerated, the cough, more frequent and easily roused, is often gurgling or rattling and may cause a discharge from the nose of a whitish flocculent, sometimes gritty material in the flocculi bacilli may sometimes be found. The breath is heavy and mawkish. Pinching of the back at the shoulders or loins may cause wincing, groaning or cough, as may also pinching above the breastbone or striking the ribs with the fingers or fist. Percussion over the ribs reveals spots where there is a lack of resonance, apart from the solid masses of the heart, liver, spleen and stomach contents, and listening over these spots will detect that variety of morbid sounds familiar to the physician, the most prominent being rubbing, wheezing, creaking or fine crepitation, mucous rattling and various blowing sounds. A remarkable feature of tuberculosis distinguishing it from many other forms of lung consolidation attended by unnatural sounds, is the occurrence of such changes in patches with intervening spaces of sound lung. Ordinary inflammations more commonly attack one portion and spread from that as a center extending the solidification in one or all directions. Arrived at this stage the animal usually fails to make flesh satisfactorily on the best feeding, and milk is not only lessened but becomes poor, blue and watery.

The tubercles tend also to form more in other organs, notably the lymphatic glands and bowels, and digestion and assimilation being thus seriously interfered with emaciation advances

more rapidly. This advance may be largely accounted for by the fact that the infecting expectorations brought up with the cough is largely swallowed to affect stomach and bowels. The animal has now diminished, and capricious appetite, irregular, infrequent, slow rumination and slight bloating after meals. The body temperature is more variable and more frequently high than in the slighter forms.

In the advance stages of lung tuberculosis everyone can recognize the consumptive animal. It is miserably poor and wastes visibly day by day, the dry coat of hair stands erect, the harsh scurfy skin clings tightly to the bones, the pale eyes are sunken in the sockets, tears run down the cheeks, a yellowish, granular, fœtid and often gritty discharges flow from the nose, the breathing is hurried and catching, the breathe fœtid. The cough is weak, painful and easily roused by pinching the back or breast or striking the ribs. Tapping the ribs with fingers or fist and applying the ear detect far more extensive changes including in many cases evidences of blowing into empty cavities (vomices) and loud gurgling. Temperature may vary from below normal to  $107^{\circ}$  Fahr.

In all such cases there is extension of the disease to distant organs and symptoms as given below complicate those of lung disease. To give means of diagnosis of tuberculosis from some diseases of the lungs which most resemble it in symptoms (lung worms, hydatids, actino-mycosis, lymphadenitis, etc.,) would unduly extend this article without corresponding advantage to my present class of readers.

*Tuberculosis of stomach, bowels and mesenteric glands.* In young animals living on milk, tuberculosis of the bowels and glands give rise to indigestion, fœtid diarrhœas, bloating, and finally enlargement of the superficial lymphatic glands and the affection of the lungs if the animal should survive long enough. In older cattle there is impaired irregular appetite and rumination, slight bloating after meals, a tendency to scour when liberally grain fed, costiveness alternating with scouring, colics, and usually a more pronounced wasting than with the lung disease. The oiled hand introduced into the last gut may detect the enlarged mesenteric glands which must be carefully distinguished from hardened fœces in the bowels from the ovaries, from masses of fat, etc.



The temperature is raised in proportion to the activity of the tubercular process.

*Tuberculosis of womb and ovaries.*—These and their supporting membranes or ligaments are often implicated in the bowel disease giving rise to undue generative excitement. They may also become primarily infected through coition. The affected cow is usually sterile, sooner or later parting with any ovum that may have been impregnated. Later her *heats* may become more intense and last longer, and never lead to impregnation. The cow spends most of her time wandering around, bellowing for the bull, and neglects to eat or ruminate and wastes away rapidly. There is often a whitish discharge from the vulva. The temperature is elevated and general tuberculosis sets in sooner or later.

*Tuberculosis of the liver spleen or pancreas.*—The liver is one of the first organs to suffer in infection through the stomach and bowels, and it may be exclusively affected in calves and even in mature animals. Tuberculosis of the liver may be accompanied by impaired appetite and digestion, bloating after meals, and in exceptional cases by jaundice, but often an indefinite ill-health is all that can be detected. Pancreatic and splenic tubercle are marked by a similar obscurity of symptoms. It is usually only when the disease begins to be generalized that distinct, objective symptoms are available.

*Tuberculosis of the kidneys and bladder* may be attended by extra sensitiveness of the loins to pinching and by frequent passage of urine, more or less discolored by blood or mixed with purulent matter. Examination of the microscopic blood casts in the urine after having stained them may reveal bacilli.

*Tuberculosis of the throat. Pharyngeal glands.*—This is one of the most common types in cattle. Attention is usually first drawn by a wheezing breathing, the sound manifestly coming from the throat, and the glands around that part are felt to be enlarged, unequal on the right and left sides, or shrunken and of a gristly hardness, or softened and even fluctuating on pressure. The formations above the throat and beneath the first bone of the neck, are particularly liable to undergo this special softening. There is usually a loose gurgling cough, some difficulty in swallowing, and a slimy discharge from the mouth. Small tubercular growths may exist on the lining mucous membrane, and this

sometimes extends into the air passages causing *tuberculosis of the larynx* with a persistent paroxysmal cough and a harsh altered voice.

*Tuberculosis of the udder.*—A portion of a single quarter is usually first affected, causing a circumscribed swelling, harder than the rest of the gland, but not hot nor painful, and this gradually extends to the whole udder. With this extension the gland becomes harder, and the milk lessened, more watery and clotted, and the lymphatic glands in front of the udder and behind are enlarged, and hardened. The gradual advance of the disease serves to disarm the milker of any suspicion and the milk is commonly utilized until its watery or grumous appearance draws special attention to the gland. The case may be tested by inoculating with the milk, or less satisfactorily by a microscopic search for the bacillus, or the tuberculin test may be applied.

*Tuberculosis of the lymphatic glands.*—In cattle the lymphatic glands are often found to be tuberculous to the exclusion of internal organs, and as this form of the disease tends to become chronic it is likely to be overlooked for a length of time. Wherever a group of these glands exists, there may be tuberculosis. In addition to those already cited may be here named :

a. *The submaxillary glands* situated on the inner side of the lower jaw at the point where the pulse is felt. These which are almost imperceptible in their natural condition, may swell up to any size, soften, burst, and discharge a cheesy matter. They are most liable to be confounded with actinomycosis of the same region but do not show the almost microscopic hard yellow clusters of the actinomyces. They yield in place the specific bacillus.

b. *The glands at the root of the ear.*—These swell in front or behind the ear, soften and like the submaxillary glands they may or may not burst and discharge.

c. *Glands inside the chest, mediastinal, bronchial, etc.*—The mediastinal and bronchial glands lying between the lungs in the centre of the chest are often affected independently of the lungs, and give no easily available symptom. A persistent nervous cough and some unthriftiness, though on good, liberal rations, may arouse suspicion, but cannot lead to diagnosis. If the *glands on the walls of the gullet (oesophagean)* are implicated the vagus nerve and stomach may be involved and digestion, rumination,

and the eructation of gas may be interfered with so that chronic bloating may be added to the suggestive, though by no means diagnostic, symptoms. Equally obscure are the indications of disease of the *glands beneath the back bone and those above the breast bone*. Of the more superficial glands of the trunk the following are the most easily examined :

*d. Glands in front of the shoulder blade.*—This group is in front of the middle of the shoulder blade, and may easily be siezed in the hands in thin cattle. If enlarged unequally on the two sides, or if very hard and nodular though small, suspicion may well attach to them. It is only on rare occasions that they burst and discharge.

*e. Glands above the stifle.*—These placed on the side of the flank in front of the stifle can also be grasped and examined. Indeed, in certain animals, notably in the Channel Island breeds, they can be seen by the eye. Swelling, inequality, hardness, nodularity are the usual suspicious features. Often smaller pea-like or hazel-nut-like masses are found scattered over the lateral walls of the belly from the last rib to the hip bones, and even in the interval between the two last ribs.

*f. External inguinal glands.*—In the male the glands on the sides of the scrotum, and in the female those on the sides of the udder may be felt to be enlarged when affected with tuberculosis.

*g. The posterior cervical glands* situated in the lower end of the furrow that lodges the jugular vein, may be similarly implicated and recognized.

The deeper seated groups of lymphatic glands, need not be individually referred to, for though subject to tuberculosis they rarely show as external swellings. Tubercles, however, may appear in any part of the skin. I have found a caseated mass like a hickory nut on the point of the shoulder, and fibrous warty-like growths on the skin, and open unhealthy sores with hard fibrous surroundings may be fibroid tubercle.

It must be borne in mind that the lymphatic glands are liable to become congested and inflamed from other sources of irritation in themselves and in their vicinity so that the mere fact of disease of these glands is no sufficient evidence of tuberculosis. It is however ground for grave suspicion, and further exculpatory evidence is demanded.



*Tuberculosis of bones and joints.*—This is especially seen in young growing animals, being common in calves in badly infected herds. Wm. Mueller has produced it experimentally by injecting the nutrient artery of the bone in a three month's goat. The bones most commonly attacked are those entering into the formation of the elbow and knee, the stifle and hock, and as the disease usually extends from the gristly growing substance in the bones of the joint surface, the trouble is recognized as disease of the joints. In some instances, however, the disease begins in the lining membrane (synovial) of the joints and forms fungous growths extending into the bone. In the open (cancellated) tissue on the end of the bone it is at first red and congested, later it is partly fatty, and caseated. Usually the disease becomes general, but if it remains circumscribed, it is enveloped in a layer of dense hard bone. The animal is very lame, perhaps even unable to rise, the joints swollen and tense, and the ends of the bones enlarged and tender. The disintegrated bone may even crumble and the sharp spiculae protrude through the skin.

#### *Further Indications of Tuberculosis.*

The above outline of symptoms seen in cattle is rendered necessary by the invariable question, "how can I recognize it?" The intelligent reader will realize from the partial sketch above, that it is no simple matter to diagnose tuberculosis. It is to be hoped that he will also have apprehended so much of the subject as will save him from being victimized, by the man who boasts loudly, but really knows little.

In the multitude of equivocal and occult cases further tests must be applied. These may be named as (1) microscopic search for the bacillus, (2) inoculation, and (3) injection of tuberculin.

*Inoculation.*—The first named test having been already incidentally referred to, inoculation may be noticed. This consists in the introduction into the peritoneum or other part, of a guinea-pig or other animal or some of the suspected product (discharge from the nose, milk, juice from an enlarged gland, etc.) General abdominal tuberculosis should be present in the guineapig in 30 days. Beside the delay, this has the draw-backs, that the guineapig may have been already infected before the inoculation, the portion of the suspected product may have been devoid of bacilli

though these were abundant enough in the animal from which it was taken, or the guineapig may have become infected after the inoculation from being kept in an infected place, or from infected food, water, attendants, etc. We must first secure for the guineapig the very guarantee we are seeking for the larger animal. Is it not then better to secure this for the larger animal first and avoid all the subsequent sources of fallacy attendant on an inoculation experiment?

*The tuberculin test* gives prompt results and is less open to fallacy.

### *Tuberculin.*

Tuberculin or *Koch's lymph* consists in the concentrated, sterilized liquids in which the bacillus tuberculosis has been grown. It contains no living bacillus; all germs have been killed by heating; but it does contain the chief poisons which are produced in the tuberculous body, and which bring about all the diseased processes in such body. A possible exception may be made of any such poisons as are destroyed by heat if any such there be, in tuberculous products. It must be distinctly understood that in every contagious disease there is, 1st, the germ which grows and multiplies in the susceptible animal system, but is not, in itself and by its mere presence, necessarily injurious, and, 2d, the products of the life of that germ which may or may not be poisonous. The many germs, which continually enter the animal body, have products that are not appreciably poisonous and therefore produce no disease, whereas the few that do manufacture poisonous products cause our different contagious diseases. We find a counterpart in the yeast germ which in itself is virtually harmless to man, whilst the alcohol, which it manufactures from sugar under certain conditions, is a poison more or less hurtful according to the susceptibility of the person taking it.

Tuberculin consists of chemical poisons which the bacillus secretes or manufactures, and on which the force and all the manifestations of tubercle in the tissues are chargeable. Having no living germ it cannot increase its own substance, nor can it cause tuberculosis in a healthy system as it is soon thrown out of the body through the kidneys and other channels and its power for evil is at an end, yet none the less is it the immediate agent

through which all the destructive work of tuberculosis is carried on. Where the bacillus tuberculosis lives and multiplies in the animal body these chemical poisons are being constantly formed, and thus its pernicious action is continuous, not only in the seat of the tubercle but through the whole system.

*Tuberculin as a Test.*

The tuberculin test is based on the fact shown by Koch that it increases the activity of the disease process in tubercle, and affects the whole animal body producing a reaction or rise of temperature in a marked degree. On the ordinary tubercle as seen on the surface, the frequent use of tuberculin produced a more active process of cell growth leading to degeneration and death, so that there was a more speedy transition from the red congested nodule, through the grayish degeneration into the dead cheesy mass, cut off from all blood circulation. If this dead mass were sloughed off leaving sound tissues to heal, that particular tubercle might be cured. But deeper tubercles usually exist and these are similarly stimulated and their degeneration hastened by the tuberculin; it is impossible for them to be cast off; the increasing masses of bacilli, which have been produced under the rapid growth, are shut up in the solid tissues around to furnish new seed for a fresh extension of the disease. As such deep seated tubercles usually do exist with superficial ones, they render tuberculin almost useless as a curative agent, since to eradicate the disease the deep caseated tubercles must be afterward removed by surgical means, a resort which might have been had at the beginning and without the use of tuberculin.

But this action which renders tuberculin so objectionable as a curative agent makes it of the highest value as a test of tuberculosis in animals. The minute dose which has no effect on a healthy cow, horse or pig, when employed on the slightly tuberculous one produces an acceleration of the disease process and in eight to fifteen hours a material rise of temperature. This has been now employed on thousands of cows and those who have used it most, value it the most highly, whereas many who at first reported reactions in non-tuberculous animals are now acknowledging with Nocard that the fault has been mainly their own, for small tubercles were present but were overlooked through their failure to examine the bones and other organs.



The explanation of the reaction under tuberculin may be very simply stated. The dose is made so small that it will not affect a healthy cow under ordinary conditions. In the slightly diseased cow the system contains a certain amount of tuberculin produced by the bacillus in the tubercles, but to this the system has become accustomed and it causes no very appreciable fever. But when in addition to this we introduce into the body of this cow the small amount of tuberculin, used for the test, the increased dose acts on tubercle and nervous centres alike and a fever is produced. So evenly balanced has been the tolerance acquired, and the amount of poison tolerated with impunity, that four drops of tuberculin will as a rule produce this elevation of temperature in the moderately tuberculous cow.

*Objection to Tuberculin as a Test.*—1st. The temperature sometimes rises in a non-tuberculous cow after the use of the tuberculin.

This is true. So does the temperature sometimes rise in a non-tuberculous cow when no tuberculin has been employed. Every animal is liable to suffer from inflammation and fever, and if such inflammation and fever set in after the use of the tuberculin test they are liable to be charged to it as their cause. This is a valid argument against the reckless popular use of the tuberculin, but surely not against its use in skilled hands. The person who uses the tuberculin on cattle must be a trained veterinarian, acquainted with the different diseases of cattle and on his guard against confounding any one of these with the temporary fever caused by tuberculin in the consumptive. If it is claimed that every rise of the body temperature after the use of tuberculin must necessarily demonstrate the existence of tuberculosis, then truly tuberculin will be discredited. But if it is held rather that a rise of temperature after tuberculin, in a cow that furnishes to the most careful and skillful comparative pathologist no evidence of other disease, implies the existence of tuberculosis, the claim is substantially correct. To secure the valuable testimony of tuberculin, the practitioner must be highly skilled in the diseases of the animal operated on. If he is not he will be occasionally misled.

Again *heat* or *bulling* may come upon a cow after the use of the tuberculin and the temperature will rise two or three degrees. To call such a cow tuberculous would be inexcusable careless-

ness. Yet the condition demanded, the rise of temperature after the use of tuberculin, is present.

Again a cow that is closely approaching calving has the temperature raised. If tuberculin has been used it is often raised higher than it would be otherwise. It is therefore improper to use this agent on a cow at this period.

Active exertion, exposure in the hot sun, confinement in a close building, the privation of water at the customary time and other conditions will cause rise of temperature. But such a rise would not imply tuberculosis, even after tuberculin.

Apart from these and other such causes of error in unskilled hands, the rise of temperature under this test should be taken not as a condemnation of tuberculin, but as a stimulus to search for small occult tubercles. A thorough search will rarely prove fruitless.

2nd. The temperature sometimes fails to rise under the tuberculin test, though the animals be in the last stages of tuberculosis.

This also is true. Here the body seems to be already so saturated with tuberculin, that the small addition made in the test makes no impression, and if we trusted to the reaction alone, we would pronounce the cow free from the disease. But such cases are easily diagnosed without tuberculin. Even the unskilled more than suspect them, and a physical examination by the skilled practitioner leaves him in no doubt as to their condition. To use tuberculin on such cows is to waste an expensive agent and to run the risk of being misled. Objection based on blunders of this kind is valid enough as an argument against the use of tuberculin by the ignorant and thoughtless, but not against its use by an able practitioner.

3d. Tuberculin causes reaction in even the slightest cases of tuberculosis, in which the victims would survive for years and might recover.

This charge is also true, and it is because of its truth that tuberculin is invaluable and indispensable as a diagnostic agent, in all attempts to put an end to the disease. An eminent German professor (Eggeling) in objecting to the use of tuberculin as a general test records the following experience. In a herd of 37 reaction after tuberculin occurred in 31, while 6 gave no reaction. When

killed the 6 proved sound and the 31 without exception tuberculous. But of the 31 only 1 had general tuberculosis and was condemned as unfit for food, and 1 was sold as second-class meat. The 29 brought first-class prices as meat, and having been only slightly affected would probably have lived for years without infecting others. Now it is submitted that the German standard as thus given is not radical enough to secure safety for man or beast, nor to give hope of an early extinction of tuberculosis. The meat of the animal with two or three tubercles in one organ is generally, but by no means always, free from the germ. When the disease does extend from such isolated tubercles, as often happens, the germ is carried not only in the lymph, but in the blood, and with tubercle in the body no one can tell when the bacillus has passed into the circulation and reached the different organs. Tubercles usually form slowly and the bacilli must have been in the blood for some time before they show as fresh tubercles in tissues and organs distant from the old ones. The meat of a tuberculous animal can never therefore be fully guaranteed as safe to eat. But again, while a cow with one or two tubercles only in lymphatic glands, may not be liable to transmit the disease to others, yet whenever an extension takes place, the germs being carried by the blood and therefore throughout the whole system, there must always be danger of their escape from the natural surfaces (lungs, udder, liver, bowels, etc.) to infect other animals. And let it be borne in mind, this diffusion through the blood takes place before its occurrence is revealed by the formation of tubercles in new situations. So long, therefore, as a single victim of even slight tuberculosis is left in a herd it can only be looked upon as an invitation to a renewed extension of the disease. It also may become at any moment a source of infection for man through the use of the meat or milk. It is only in degree that the contagion of tuberculosis differs, as to its sanitary aspect, from that of any one of the more contagious diseases, and in all alike so soon as we attach more importance to the preservation of an infected animal that will probably recover, than we do to the radical extinction of the disease, we undermine and destroy the effectiveness of our sanitary work. Practically all cases of foot and mouth disease recover; yet the frequently recurring epizootics of this disease each cost from \$5 to \$10 per head over the entire



bovine population. Of the victims of Rinderpest and Lung Plague that do not speedily die practically all recover. Are the slighter cases therefore to be kept alive to perpetuate indefinitely those disastrous visitations that sweep away values of hundreds of millions? Is the remorseless scourge of tuberculosis to be perpetuated, not only in herds, but in our homes as well, to save for a few months or years some tuberculous cows? No country has ever dealt successfully with any of these animal plagues on the basis of preserving the mild cases for recovery. Always and everywhere it has been by the radical and thorough extinction of the disease germ wherever found, that success has been achieved. While this cannot be done for man, it must be done for our flocks and herds if we would ever cut off this prolific animal source of tuberculosis from the human race. Even as regards the herds themselves the stockowner who would consult his own future interests, would at any cost exclude from his barns and fields every possible source of future tuberculosis.

As will be shown below the meat and milk of tuberculous animals contain tuberculin (even when they do not contain the bacilli), and serve to aggravate any existing or latent tuberculosis in man.

4th. A fourth objection to the tuberculin test is its alleged liability to produce tuberculosis in healthy animals, or to aggravate it in the tuberculous ones.

Now tuberculin, properly prepared is absolutely sterilized, so that it can plant no living germ nor start the growth of any tubercle in a healthy animal. The further claim that it aggravates tuberculosis which is already in existence, is too true, and is the sound basis of its value as a test. As a means of testing the existence of tuberculosis in man it cannot be too strongly condemned, since no man has a right to seal the fate of his fellow for the sake of finding out if he has tuberculosis. The same condemnation must be passed on the use of tuberculin as an alleged curative agent, except in those few cases in which the tubercle is confined altogether to the surface of the body, whence it can easily be sloughed off. The existence or possible existence of an internal or deep-seated tubercle in man should forbid the use of tuberculin for diagnosis or for curative purposes.

The same remark would apply to animals if we adopt the Ger-

man view that it is impolitic to destroy those that are only slightly affected. If tubercle exists, to however limited an extent, tuberculin tends to aggravate it, and the owner who wishes to preserve his mild cases cannot desire to have them made worse, which means to have the disease extended and possibly generalized.

So in government sanitary work. Unless the government is prepared to slaughter and pay for every animal affected with tuberculosis in however slight a degree, it has no right to use a tuberculin test. It is only when the State means to make thorough work in eradicating tuberculosis from the herds that the tuberculin test is at all admissible. But when the State aims at the thorough extinction of the disease in our herds this test cannot be omitted, as it is absolutely essential to success. The temporary aggravation of the disease is no possible harm, when the animal is to be promptly killed and paid for.

To sum up: The tuberculin test aggravates existing tuberculosis and is, therefore, unwarrantable for use on man or on cattle that are to be kept alive; it is, however, the only known means of detecting many occult cases of tuberculosis and is, therefore, indispensable in any systematic effort to *stamp out* the disease by the purchase and slaughter of every tuberculous animal.

#### MEAT AND MILK OF TUBERCULOSIS ANIMALS UNFIT FOR FOOD.

In this connection we must consider two questions essentially distinct from each other and equally important in a sanitary sense. The first is the question of *infection* by the use of such food products, and has been very fully investigated by pathologists and sanitarians. The second question—is that of *poisoning* by the pernicious products of the germ and has hitherto been entirely ignored by sanitary writers and administrators. It will be convenient to consider these questions separately.

##### I. INFECTION BY BACILLI IN MEAT AND MILK.

First however it will be instructive to compare the geographic distribution of cattle and that of tuberculosis, not with the view of showing that most of the tuberculous infection of man comes from cattle, for it probably comes mainly from his fellowman, but to demonstrate rather that in some way the intimate relation of cattle to man is a potent agent in the extension and maintenance of consumption in the human family. To the student of this

subject it is plain that where cattle are few or absent consumption is relatively less prevalent in man. In northern Norway, Sweden, Lapland and Finland where reindeer constitute the chief farm stock, about Hudson Bay and in the islands of the Pacific where no cattle exist, and in the Scottish Hebrides, Iceland and Newfoundland where cattle are few, tuberculosis is far less prevalent in man. In Algiers (a resort of consumptives) the cattle are few and live in the open air apart from the cities and tuberculosis does not increase among the natives. In Italy (another resort of consumptives) where cattle are housed, tuberculosis has become the scourge of man and beast (Perroncito). In Australia (a great resort for the English consumptive) the disease, formerly unknown, has become exceedingly prevalent, and the same is becoming true of our own Minnesota formerly so lauded as favorable to weak lungs.

In the temperate regions of Europe and the United States at least every eighth death is due to consumption. Dr. Biggs tells us that in New York City every fifth death is from tuberculosis of the lungs. He adds that in the Charity hospital of the city 30 per cent. of all deaths show old lesions of tuberculosis now become stationary. He quotes a Vienna hospital pathologist to the effect that he finds similar old stationary lesions in 85 per cent. of all post mortem examinations. This leaves but 15 per cent. who have not suffered from tuberculosis.

But our Northwest Indians furnish the most striking illustration of infection derived from cattle and fostered in man by unhygienic surroundings. Dr. Treon in the *American Practitioner* describes the poor emaciated diseased animals furnished to the tribes, how the Indians eat the liver, tallow and entrails raw and fresh, and how the carcass is dried, pounded and packed in the skins to be eaten later without cooking. The meat is eaten even though the animal may have died of disease. Dr. Holder in the *Medical Record* (August 13, 1892) gives the Indian mortality from consumption as 50 per cent. of all deaths at Green Bay, Wis., Tulalip, W. T., and Western Shoshone, Nev. He says that at Lower Brulé, Dak., scrofula is present in 60 per cent. of the Sioux under 21 years and that at Crow Creek, Dak., 50 out of a total Indian population of 1,200 die yearly of consumption and scrofula. Taken



along with half as many deaths from other causes this would kill the whole 1,200 in 16 years.

These are extreme examples it is true, in which the transmission and fostering of the disease by cattle is extended and aggravated by overcrowding and every imaginable unhygienic condition, among the human consumers.

### *Experimental Tuberculosis by Feeding.*

The experimental transmission of tuberculosis by feeding tuberculous products was demonstrated by Villemin, Günther and Harms, Zurn, Gerlach, Johne, Kolb, Toussaint, Chauvean, Peuch, Leisering, Bollinger and a host of others, the animals infected in this way including Guinea pigs, rabbits, fowls, swine, sheep, goats, dogs, cats and birds. Infection was by no means so constant as when inoculation was performed, yet in 322 experiments recorded by Johne 13 per cent. became tuberculous. The varying results depend on a variety of causes, among which may be named :—

1st. The relative susceptibility of the various animals experimented on. As we know this varies greatly with the genus, species, family and even the individual.

2d. The condition of the digestive organs at the time of feeding. The bacillus tuberculosis lives in an alkaline or neutral medium and suffers weakening or even death in an acid liquid like the contents of the stomach during active digestion. If therefore the subject of experiment has a strong digestion, and if infecting matter is taken only during active digestion, infection is usually promoted. If on the other hand the infecting material passes through the stomach in water or otherwise in the intervals between digestion when the stomach is neutral, if there is indigestion so that the contents are only mildly acid, and infecting morsels pass into the bowel without having been digested or thoroughly impregnated with acid, or if the stomach is overloaded so that part of its food passes on undigested, then manifestly infection is possible or probable. Again if there are raw sores on the mouth, throat or gullet or if the germ happens to lodge in the recesses of the bowels or pass down into the lungs infection may start from any such point as a center.

3d. The germ is more or less virulent according to the animal

from which it is derived. Thus the virus from the ox which proves certainly fatal to the guineapig on inoculation, cannot be successfully inoculated under the skin of the guineapig after it has passed through several generations in as many birds, but if inoculated from the bird in the abdomen of the guineapig and continued for several generations in this rodent it reacquires all its former potency (Nocard, etc.). So to a less extent with cattle; from one cow the inoculation invariably produces the disease; from another only occasionally. The same must hold in feeding.

4th. The degree of infection of the material fed has much influence. Tuberculous glands, and tubercles whether recent or caseated are of course the most certainly infecting. The blood and red flesh (in the ox) may be said to be the least frequently infecting, while the infecting power of milk will vary according as the udder is or is not the seat of tubercle. Toussaint who seems to have met with especially virulent cases inoculated successfully with the blood, nasal discharge, bile, urine, tears, flesh juice, dung, etc., of a tuberculous cow. Others like Nocard and McFadyean have failed with blood and flesh juice. The danger may be estimated by taking a middle position. It may be well to consider the blood, flesh and milk separately.

#### *Dangers from Blood.*

It cannot be denied that blood is inimical to this bacillus as to most other microbes. Even if the virus is injected into the veins in such quantity as to produce general tuberculosis, the germs become largely arrested in different organs or robbed of their virulence so that in a few days the blood is comparatively little infecting. This does not, however, do away with the fact that the injected bacilli live long enough in the blood to produce tubercles in many different organs, and the same is true when the disease extends from single primary tubercles, to a general tuberculosis; in most cases the bacilli can only have travelled through the blood. Bang found that of 20 cows in advanced tuberculosis, the blood of only two (or 10 per cent.) proved infecting when inoculated. Nocard has never succeeded in producing the disease by injecting the blood of a tuberculous ox into the abdominal cavity, yet he recognizes that as the disease extends by means of bacilli conveyed by the blood, this liquid must be infecting wher-

ever these bacilli are contained in it. As the migrating bacilli must be present in the blood before these secondary tubercles can be formed by them in organs distant from the tubercles that gave them birth, it follows that this infecting condition of the blood must precede the formation of the secondary tubercle, or general tuberculosis. While therefore it is quite true that the probabilities of infecting blood are greatly increased when the tubercles are numerous and generally diffused, it is an error to assume that the restriction of the tubercles to one organ is a guarantee that the blood is non-infecting. And when we cannot give a guarantee for the blood we can give none for any part or organ in which blood circulates.

*Danger from Flesh.*

It would seem as if the muscle or red flesh in cattle were antagonistic to the bacillus tuberculosis. Certain it is that tubercles are rare in the substance of the muscle. They are, however, very common in the lymphatic glands lying between the muscles, and in swine they are common in the substance even of the red flesh. The flesh of tuberculous pigs is therefore far more dangerous than is that of consumptive cattle. Even in tuberculous cattle, however, the beef is not always free from bacilli as shown especially by the crucial test of inoculating its juice. Arloing tested 10 tuberculous cattle in this way by inoculating guinea-pigs and found that the muscle from two of the cows only (20 per cent.) proved infecting, and that only 3 of the 10 guinea-pigs inoculated by the muscle juice of these two cows became tuberculous. Galtier fed two calves and two young pigs with the raw flesh of a tuberculous cow, but failed to infect them. This failure was, however, not necessarily due to the absence of bacilli, since two rabbits inoculated with juice from the same flesh contracted tuberculosis. Nocard fed several litters of young kittens on the flesh of cattle condemned as tuberculous, at the abattoirs of La Vilette and Grenelle, but none of them contracted tuberculosis.\* Perroncito fed 18 young pigs from three to five months on the flesh of cattle condemned as tuberculous in the Naples abattoirs, yet none became tuberculous.

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\* By inoculation with the muscle juice of tuberculous cattle Nocard infected 5 per cent. of the subjects of experiment.



Two things are shown by the above: (a) that the red muscle is less frequently infecting than other parts, yet unquestionably so in some cases; and (b) that the acid stomach juices during vigorous digestion are in some measure protective. It is equally plain that no sufficient guarantee can be given as to the safety of the raw flesh in any particular case. Then, again, the intermuscular lymphatic glands, which are favorite seats of infection, were carefully avoided in the above experiments with flesh juice, yet they always go with the dressed carcass and are eaten with its steaks and roasts. In pigs, as already noted, the muscle itself is often tuberculous.

#### *Danger from Milk.*

Milk is more to be dreaded than meat because the udder is often the seat of tuberculosis, and the milk is usually taken uncooked. The danger is enhanced by the fact that this is often the necessary and only food of the infant and invalid, in which the germ is especially liable, through weak and imperfect digestion, to escape into the susceptible bowel.

In milk, as in the case of meat, a strong, vigorous digestion does, in some measure, protect the consumer. Peuch fed a two months' pig in five days  $4\frac{1}{2}$  quarts of milk drawn from a tuberculous udder, and killed in 56 days it proved quite sound. He inoculated four rabbits with the milk and all four became tuberculous. Again, in the absence of tuberculosis in the udder the milk may be little, if at all, infecting. Gerlach, who produced tuberculosis in calves, pigs and rabbits by feeding the milk, found no result from certain tuberculous cows, while others infected a large proportion. Nocard and McFadyean have been unable to infect rabbits, etc., with milk from an apparently sound udder of a tuberculous cow. The same has been my experience with milk from one cow in the last stages of chronic tuberculosis, and another having acute tuberculosis. Bollinger. Nocard and McFadyean claim that in the absence of tubercle in the udder the milk is not infecting. Whether true or not as an ultimate fact this cannot be made a rule of action, as the following will show:

Hirschberger inoculated rabbits in the abdominal cavity, with the milk of 29 tuberculous cows of which the udders were or appeared sound, and produced tuberculosis 14 times.

Bang inoculated from 63 tuberculous cows selected for their sound udders, and found the milk of 9 of them infecting. A careful microscopic examination revealed tuberculosis in the udders of three of the cows, leaving six giving infecting milk in which even after death, and with all scientific appliances no tubercle could be found in the udder. This is 9.5 per cent. as tested by the microscope after death; it was 14.28 per cent. as tested by the able veterinary professor during the life of the cows.

Ernst found 10 cows in 35 with infecting milk though the udders were sound. In 103 animals inoculated 17 contracted tuberculosis, and of 12 calves sucking the cows 5 became tuberculous.

Drs. Smith and Kilborne (Bureau of Animal Industry, Bulletin No. 3.) found the milk infecting in three cows out of six with apparently sound udders. One infecting cow, and one non-infecting one had each tubercle in the lymphatic gland behind the udder. Forty-four per cent. of the inoculated guinea-pigs contracted tuberculosis: 1 in 5 from one cow, 8 in 10 from another and 6 in 6 from the third.

In my own experience three calves, from healthy parents, sucking the apparently sound udders of three cows with general tuberculosis all contracted the disease.

It must be allowed that calves sucking the cows run extra risk of infection through their nurses licking them and through feeding from a common trough, but there is the same danger for the ordinary milk consumer, since the cow in licking her udder is liable to leave bacilli to fall into the pail at the next milking.

Again the concentration of the bacillus in the indiluted milk of an infecting cow, renders this much more dangerous than the milk of the same cow diluted, with that of 20, 50 or 100 others. Bollinger and Gebhardt found that milk which infected all animals that took it pure, was apparently harmless when diluted with 50 or 100 times its volume of the milk of sound cows. As the bacillus can live in milk this apparent loss of virulence must be largely due to the reduction of the number of bacilli in a given measure of milk, and to their tendency to removal by adhering to the sides of the vessel during the mixing.

Tuberculous expectoration which is incomparably richer in bacilli

may be diluted in 100,000 times its volume of water and yet remain infecting. But again the glutinous saliva forms a protecting coating which strongly resists dilution.

*Infection of Man Through the Milk.*—Instances of accidental tuberculosis of the human being through drinking the unsterilized milk are no longer wanting.

In the practice of Dr. Stang of Amorback, a well developed five year old boy, from sound parents, whose ancestors on both male and female sides were free from hereditary taint, succumbed, after a few week's illness with acute milliary tuberculosis of the lungs and enormously enlarged mesentric glands. A short time before the parents had their family cow killed and found her the victim of advanced pulmonary tuberculosis. (Lydtin).

Dr. Demme records the cases of four infants in the Child's Hospital at Berne, the issue of sound parents, without any tuberculosis ancestry, that died of intestinal and mesenteric tuberculosis, as the result of feeding on the unsterilized milk of tuberculous cows. These were the only cases in which he was able to exclude the possibility of other causes for the disease, but in these he was satisfied that the milk was alone to blame.

After a lecture of the author's at Providence, R. I., a gentleman of North Hadley, Mass., a graduate of the Massachusetts Agricultural College, publicly stated that his only child, a strong, vigorous boy of one and one-half years, went to an uncle's for one week and drank the milk of a cow which was shortly after condemned and killed in a state of generalized tuberculosis. In six weeks the child was noticeably falling off and in three months he died, a mere skeleton, with tuberculosis of the abdomen. The father could trace no tuberculosis among his near ancestors, but the mother's father and uncle had both died of it. She remains in excellent health.

Dr. E. O. Shakespeare (*Med. News*, March 26th, 1892) attributes one-fifth of all deaths in infants and young children, feeding on milk, to tuberculosis usually commencing in some part of the digestive organs.

*Identity of tuberculosis in cattle and man.*—This is abundantly proved in the above instances of the infection of man through the milk and in the hundreds of cases in which the tubercle of



man has been successfully inoculated on the lower animals. As evidence of direct transference of the disease from cattle to man by inoculation the following two cases are quoted :

Tscherming, of Copenhagen, attended a veterinarian who had cut his finger in making a post mortem examination on a tuberculosis cow ; the wound healed, but there remained a swelling which soon ulcerated and refused to heal, so that the whole tumefied mass had to be cut out. The microscope revealed the distinct tubercular process and the presence of the characteristically staining bacilli.

Pfeiffer attended a Weimar, veterinarian of the name of Moses, 34 years old, of a good constitution, and without hereditary predisposition, who, in 1885, cut his right thumb deeply in making a post mortem examination of a tuberculous cow. The wound healed but six months later the cicatrix still remained swollen, and in the autumn of 1886 the man had pulmonary tuberculosis with bacilli in his sputa and death occurred in two and a half years after the wound. Post mortem examination revealed tuberculosis of the joint of the wounded thumb, and in the lungs extensive tubercles and vomicæ.

To Tscherming's may be added the case of a young veterinary friend of the writer, who was inoculated in the hand in opening a tuberculous cow, and suffered from a tumefaction of the resulting cicatrix, with distinct tubercle bacilli. The surgical removal of the tumefaction manifestly saved the subject from a generalized tuberculosis.

## II. POISONING BY PTOMAINES AND TOXINS, IN MEAT AND MILK OF TUBERCULOUS ANIMALS.

By an unaccountable oversight medical and veterinary Sanitarians alike have never, up to the present hour, looked beyond infection by the tubercle bacillus in estimating the dangers to man of tuberculosis in our flocks and herds. We find accordingly that the question kept continually before the public is that of the presence or absence of the tubercle bacillus in any food product, —meat, milk, butter or cheese—furnished by the diseased or suspected animal. The question of the presence or absence of ptomaines or other toxic elements which are calculated to prove

hurtful or even fatal to certain members of the human race is not for a moment considered.

Hence we are met by the most elaborate arguments that tubercle is rare in the muscular system of cattle, and that muscle juice is inimical to the bacillus and that therefore the muscular tissue which forms the great mass of the dressed carcass may, as a rule, be safely eaten even though the internal organs may have been affected by tubercle. In Germany and other European countries the flesh of animals in which the tubercles are found in only one organ or in two related ones, is passed as wholesome. It is only when the tubercles are found in the bones, or muscles, or in the lymphatic glands among these, or finally when the tubercles are so generally distributed in different parts of the body that it is evident that the bacilli must have been carried by the blood, that the meat is rejected as unfit for human food. So with milk and other dairy products; many claim with Nocard and McFadyean that the milk is harmless so long as the udder is quite free from tubercle, and that it is only when tubercle is unmistakably present in that gland that this secretion is to be feared. Apart altogether from these discussions as to the wholesomeness of uncooked flesh and milk it is safe to say that up to the present, every writer on the subject holds that even the infecting tuberculous meat and milk is rendered absolutely harmless by cooking. The consensus of professional opinion on this subject is tersely given by Salmon and Smith in their article on tuberculosis in the work on the "Diseases of Cattle" published by the Bureau of Animal Industry—"Fortunately tubercle bacilli are readily destroyed by the temperature of boiling water, and hence both meat and milk are made entirely safe, the former by the various processes of cooking; the latter by boiling for a few minutes."

But this is altogether too narrow a view to take of the subject, and it is liable to lead to most serious and fatal results if put into every-day practice. The professional mind, in concentrating its attention on *tubercular infection*, has practically entirely overlooked the no less real and, in many cases, no less dangerous fact of *tubercular poisoning*. To elucidate this matter let us consider that much of the poisonous matter produced by the growth of the tubercle bacillus is retained in Koch's "tuberculin," which has been absolutely sterilized. What, then, is the action of "tuber-

culin" on the animal system? It produces a constitutional disorder with elevation of the body temperature, commonly known as fever, and an impairment of most of the bodily functions, notably those of assimilation and secretion. This is abundantly manifest in the wasting and fever of the victim of acute tuberculosis in which these poisonous principles are being constantly produced in large quantities. As the dose is reduced, a point is finally reached at which no fever nor appreciable systematic derangement is produced, and thus in many slight and indolent cases of tuberculosis the animal appears well, and thus, also, the usual test dose of tuberculin has no recognizable disturbing effect on the healthy animal system. With a dose less than this it may even be questioned whether it may not be actually beneficial in conferring on the healthy system a small measure of tolerance and power of resistance to the bacillus and its poisons. This, however, is of little account, seeing that no real immunity from tuberculosis is ever acquired. In many systems, both human and brute, the disease continues its slow progress for many years, and the slight tolerance that results, while it may suppress the disease so that it assumes an indolent and chronic form, does not fully arrest it.

Very different is the effect of even a minimum dose of tuberculin on a subject which is already attacked with tuberculosis. In such a case the products of the existing tubercle, circulating in the blood and tissues, are often so small in amount and the system has acquired such a tolerance of them that there is no manifest disturbance of health and the animal may even be in excellent condition. But add to this minimum amount of poison already in the system a small quantity of tuberculin and in ten or fifteen hours the temperature of the patient's body will rise two or more degrees above the normal, and the destructive process going on in the seats of the tubercles will be accelerated. In cattle this is now used as a most valuable test of the presence or absence of occult tubercle. In horses and other animals, the subjects of tuberculosis, "tuberculin" causes the same rise of temperature, and this rise may be accepted as a rule applicable to all classes of animals. In the tuberculous man this action of "tuberculin" is a well established fact, and was made the basis of Koch's employ-



ment of this material as a curative agent. The daily use of tuberculin in cases of lupus or other superficial forms of tuberculosis led to a more active congestion and an earlier molecular death of the tissues of the local tubercle, until these were separated from the living, healthy parts and the progress of tuberculosis in that part was arrested. If there were then no deeper unseen tubercles left in the system, a real cure might be effected in this way. But the cure in such a case was only secured by a temporary aggravation of the disease in its primary focus. If other tubercles existed in internal organs they, too, had the morbid process aggravated and extended and the death of tissue increased by the fresh introduction of tuberculin from without. In such a case the increased mass of tubercle—dead and living—remained confined in the midst of the surrounding tissues, and as the infecting materials could not be cast off and separated from the body, they continued their ravages with an increasing force in proportion to their recent artificial extension.

It is this extension of the tuberculosis under the influence of the toxic products of the bacillus which raises the most important question in connection with the consumption by man of the flesh and dairy products of tuberculous animals and yet this question has been overlooked by sanitarians in the most unaccountable way. It has seemed enough for them that the living tubercle bacillus did not exist in the juices of the muscles nor in the milk. It seems never to have occurred to them that all the soluble poisonous products of this bacillus were constantly circulating in the blood which passes through the muscles, and that they equally traversed the blood vessels of the mammary glands and escaped into the milk. No pathologist can for a moment doubt this general diffusion of these products in the tuberculous subject.

Accepting then as undeniable the presence of the soluble chemical poisons in blood, flesh and milk, it follows that those who eat this flesh or milk are continually taking in small doses of tuberculin, and that in case they are already the victims of tuberculosis in however slight or indolent a form, this continuous accession of the poison will rouse the morbid process into greater activity and secure a dangerous extension.

If we now consider the frightful prevalence of tuberculosis in the human race, that here in New York every eighth person dies of tuberculosis, that in cities like Vienna 85 per cent. of the people suffer from it, and that in our own cities 30 to 50 per cent. contract it at some period of life, we see what a fearful risk is being run by the utilization of the meat and milk of animals so affected, even if it could be shown that such meat and milk were in themselves free from the living bacillus. Such reckless consumption of the products of tuberculous animals can only be looked on as a direct means of sealing the fate of that large proportion of the community which are already slightly affected with tuberculosis.

The claim that the canning of tuberculous carcasses and the boiling or Pasteurizing of milk does away with every element of danger can no longer be entertained. Sterilization is not a restoration to a non-poisonous condition: it does away with the possibility of infection, it is true, but it does not render the product innocuous.

As a matter of fact Koch's tuberculin has been sterilized by heat, but this has not by any means rendered it safe and harmless. On the contrary it invariably intensifies any existing tuberculous process and develops fever and general constitutional disorder. When tuberculin, therefore, is present in meat and milk it can only cause these to operate in the same way on subjects that have been already infected. In my experience with tuberculous cows, cases have come to my knowledge in which invalids drinking the milk of such animals have suffered very obviously and have improved after such milk was withheld. So too in the case of calves sucking phthisical cows: they have done badly and proved unthrifty though they took the whole of the milk furnished by their respective nurses, and they have thriven better when weaned and put upon solid food alone. I have followed some such calves until they grew up and were slaughtered, and have made post-mortem examinations and found them bearing old calcified tubercles pointing back to the time when they sucked the infected and poisonous milk.

It is idle to say that such milk was merely lacking in nutritive principles:—the calves in question had access to other food, while

following their nurses, and would not have been harmed by taking the same amount of pure water as they took of milk. Apart from the bacilli, which operated slowly, and which allowed these animals to live for years and even thrive after they had ceased taking the milk, there was unquestionably in this secretion a definite poison which undermined the health and stimulated the progress of the tuberculous process. Accessions of bacilli are not denied, but at the worst these acted tardily, and apart from the soluble poisons their action must have been cumulative up to the cessation of the milk feeding, so that immediately after the withdrawal of the milk the morbid action should have been greater than at any time before this, whereas in the cases in question improvement dated from the change to dry coarse food.

K. Yamagiva in his experiments on guineapigs obtained corresponding results. After inoculation with tubercle, the administration of tuberculin greatly hastened the onset of general tuberculosis so that after a week tuberculous centres were found in lymphatic glands, spleen, liver and lungs.

If this is the result in guineapigs which though very subject to tuberculosis are not easily poisoned by tuberculin, how much more so in man who is many thousand times more susceptible to tuberculin? The healthy guineapig is almost unaffected by 2 grammes of tuberculin, while man weighing eighty times as much is seriously affected by  $\frac{1}{20}$  gramme. In the tuberculous condition the guineapig reacts violently under  $\frac{1}{4}$  gramme, while man is seriously affected by  $\frac{1}{1000}$  gramme. Weight for weight being considered it follows that the consumptive man is 20,000 times more susceptible to the tuberculin poisons than is the guineapig. From this may be inferred the danger to the tuberculous man, of meat or milk containing the poisons of tuberculin.

It may be safely held as proved, by analogy, observation and experiment that the soluble poisons of tuberculosis invariably operate by exaggerating any existing tuberculous process, and that blood and all animal fluids becoming charged with such poisons uniformly tend to further endanger the health or even the life of any person who may consume them while suffering from tuberculosis.

We may freely allow that the transmission of the bacillus from



man to man is far more common than from beast to man. But though the implanted seed may have been in many cases derived from a fellowman, its subsequent destructive progress may be due far more to the constant accessions of the soluble poisonous products conveyed in the meat and milk of tuberculous animals. Without these constant doses of soluble poisons of tubercle, the implanted germ would in many cases have proved comparatively harmless. Although it could be proved in regard to many cases that the cow had not contributed the seed of the diseases, she is left little less responsible for the destructive progress and fatal result. The germ which might have remained comparatively dormant and harmless in the absence of the poisoned meat and milk is by these stimulated to a more deadly energy.

#### HOW TO MEET THE DANGER.

This hitherto unchallenged factor in the progress of tuberculosis, opens up new and uncultivated fields for sanitary work. The great evil ventilated in this paper cannot be effectually met without the eradication of tuberculosis from every herd kept for the supply of food products for the public. Nothing short of this can be trusted to act satisfactorily in putting a check upon the present fearful mortality from this disease. No inspection of dressed carcasses, nor of milk, butter and cheese will furnish a guarantee. We must go to the herds and subject them animal by animal to a critical test, and only accept the products as safe when there is no longer a shadow of suspicion remaining. A professional examination of the most searching kind must be supplemented by the "tuberculin" test before a clean bill of health can be furnished. In my own experience on cattle two thirds of the cases of tuberculosis sometimes escaped under the most critical professional examination and were detected later by the "tuberculin" test. Often, when cattle were condemned by the "tuberculin" test, have the owners pronounced them the most thrifty and the least suspected in the herd, and it was only after slaughter, when the bodies were opened and the caseated tubercle exposed, that they were satisfied that no mistake had been made. Recently in a herd kept for the supply of high priced milk of guaranteed soundness, the stock having been subjected to weekly

examinations by a veterinarian, the "tuberculin" test was applied and 50 per cent. of the herd demonstrated to be tuberculous. Without the "tuberculin" test there is no guarantee possible for the products of the dairy, and the sanitary officers who will affect to deal with this disease in herds without the aid of "tuberculin" are at best but pruning the tips of the branches of the evil tree. Public money ought not to be thrown away on such fruitless and ineffective work. The purification of a herd must be followed in every case by a thorough disinfection of contaminated buildings and places, and by a careful seclusion of the herd from new sources of infection. It is evident therefore that the nontuberculous herd must be secured against the addition of fresh animals from any herd that has not been similarly attested sound, and that any necessary addition from another source must be tested by "tuberculin" before it is added to the herd. Equally important is it to test all farm animals of whatever species which live on the place and cohabit with the herd, and to see to it that no human being suffering from tuberculosis is allowed to attend to the animals or to prepare their food. It is difficult to see how anything short of such a system can afford a guarantee of the absence of the soluble tubercle poisons from our milk, butter and cheese.

In the case of butcher meats a professional examination when slaughtered, covering all of the viscera as well as the carcass, will be essential, and the current doctrine of sound meat with localized tuberculosis must be abandoned. Every municipality must have its own public abattoir in which alone its meat supplies should be butchered and where every carcass should be systematically examined as it is opened. Private slaughter-houses controlled by individual owners afford endless opportunities for the evasion of sanitary statutes, and ought to be abandoned as relics of an age when modern sanitary science was unknown.

The question of dressed, canned and salted meats is one that must be carefully considered. It is quite evident that such products must come to us with a sufficient guarantee if allowed to compete with our home meats which have passed the municipal inspection. It is equally evident that no inspector paid by the packer or canner can furnish a certificate which will command public confidence. The inspector must be a government official who

is entirely independent of the packers and who is in no way dependent on their good will.

Then again the existing method of furnishing government inspectors at our great packing centers only, and thus giving a monopoly to the large operators, cannot be long maintained in a country of equal rights and privileges. The most obvious cure for this evil is to make all packing establishments government institutions, where the small packer shall have equal privileges with the large, and where all carcasses shall be subjected to the same scrutiny and all shall go out with the same guarantee.

Such a proposition will doubtless be severely criticized both from the medical and economic standpoint.

On the medical side it will be argued that if the soluble poisons in the meat and milk were as injurious as represented, we would see the evil results on every side and that medical men would be universally cognisant of them. And yet do we not see clearly to-day much that was never suspected twenty, thirty or fifty years ago? How recent is the acceptance by the profession of the doctrine of contagion in tuberculosis, in tetanus, in pneumonia, in influenza, in glanders, etc. Are we to suppose that our forefathers were surrounded by fewer evidences of contagion, at a time when no precautions were taken to prevent it, than we are with all the antiseptic and antizymotic provisions of the present day? The facts of contagion were doubtless more abundant in their days than in these, but their attention had never been drawn to them. So now let the attention of physicians and sanitarians be given to the morbid action of soluble poisons of tubercle and evidences of their evil results will accumulate on all sides. It is the scrutiny and not the facts that are wanting.

The economist will object to drastic measures for the suppression of tuberculosis on the ground of expense. Who is to pay for the municipal abattoirs, the inspectorships, the disinfections, and the indemnities for slaughtered animals? In return let me ask, who now pays for the constant losses of live stock which the proposed system would put a stop to; for the frequent infection of sound herds by unfortunate purchases of animals that prove to be tuberculous; for the losses to the nation, to the community and family of the tuberculous one-eighth of all deaths; for the loss of



work—literary, scientific, manufacturing, commercial, domestic and manual of the great host of consumptives waiting all over the land to fill the places of this fatal eighth in coming mortality statistics: for the losses represented by the bills of the physician, nurse and druggist for these invalids; and for the losses represented by the many migrations and exiles in search of health and of the costly consumption hospitals and sanatoria? And who is to pay in the future for the needless harvest of similar fruits, which the seeds now sown through our supineness, must inevitably produce in the coming generations?

Is it not a truer economy to destroy the seed before it has germinated, or even before it has been sown, than to wait for the multitudinous evils that must attend on its growth and fructification?

#### PREVENTIVE MEASURES FOR ADOPTION BY THE STOCKOWNER.

If he will the stockowner can extirpate this disease from his herd and thereafter keep the herd pure from such contamination. The following are the main precautions necessary to this end:

1st. Board up the partitions of the stalls at the front so that no two cows can feed from the same manger nor lick each other.

2d. Keep each animal strictly by its own stall and manger.

3d. When any animal is suspected don't let it use a drinking trough nor bucket in common with other animals.

4th. Avoid old milch cows and unthrifty ones, or keep them secluded from the rest of the herd.

5th. The following conformation usually indicates a weakness of constitution and a susceptibility to tuberculosis: Head narrow between the horns, sunken eyes, depth of cavity (temporal) back of the eyes, thin narrow ewe neck, chest small, lacking in both breadth and depth, hollow flank and tendency to pot belly, a general lack of muscle so that the limbs seem loosely attached to the body, in breeds that show a variety of colors, animals of the lighter shades of brown and yellow. If, however, such animals are of high value for the dairy, and can be kept free from infection they need not be rejected. The finest conformations of shorthorns, Devons, Holsteins, black or red polled furnish no protection in the presence of the germ.

6th. Don't purchase from a herd in which tuberculosis has appeared or in which cattle have died or been killed within a year or two. Resort first to the tuberculin test.

7th. Don't take a cow with a husky or rattling cough, wheezing, hurried breathing, discharge from nose, foetid breath, hard bunches under the skin, diseased udder, swollen bones or joints, unthriftiness, or a tendency to scour or bloat.

8th. Don't purchase from city, suburban nor swill stables.

9th. Don't add newly purchased cattle to your herd until you have tested them with tuberculin, especially if they have been the product of inbreeding.

10th. Don't admit strange cattle to house, field nor yard with your own; keep them apart until tested with tuberculin.

11th. In case of disease or unthriftiness in your herd put the animal apart and have it examined by a skillful veterinarian.

12th. If after this there remains any doubt as to the real nature of the disease, have the animal tested with the tuberculin, in the hands of a practitioner thoroughly acquainted with cattle and their diseases. If the result is not yet quite clear keep the animal by itself and repeat the test in four weeks.

13th. In case one animal in a herd shows tuberculosis test the whole herd with tuberculin.

14th. Test in the same manner all animals on the farm (swine, goats, sheep, horses, rabbits, cats, dogs, fowls) that cohabit with the cattle.

15th. Kill all tuberculous animals and boil, burn, dissolve in acid, or bury deeply in a place to which no animals have access.

16th. Disinfect premises thoroughly, also all products of the diseased animals and all articles used about them.

17th. Let no consumptive person attend on cattle or other live stock, nor prepare their food.

18th. Vermin (rats, mice, sparrows) in a building where tuberculous animals have been, should be exterminated.

#### STATE MEASURES FOR THE PREVENTION AND EXTINCTION OF TUBERCULOSIS IN FARM ANIMALS.

The best, most effective, and economical measures for the suppression of tuberculosis are those which naturally devolved on

the State. It does not follow, however, that State interference will exonerate the stockowner from his personal duty in taking the precautions laid down for him above. It is the duty of the State to see that all such precautions are enforced, together with others that transcend the power of the individual stockowner, and must be undertaken by the governing power for the public good. Among these may be named the following :

1st. The providing of municipal slaughter houses in which alone farm animals designed for human food can be slaughtered.

2d. Exclusion from the home market of all dressed, salted and canned meats, that have not passed a crucial examination at the time of slaughter by an accomplished government veterinary inspector.

3d. Government stamping and labelling of all canned meats that have passed the municipal inspection and can be guaranteed as from nontubercular animals.

4th. Forbid the use for pigs, fowls or other animals of all milk furnished by tuberculous animals, and of all offal or other products of slaughter-houses until they shall have been boiled for one hour.

5th. Provide for the systematic inspection by skilled and reliable veterinary practitioners, of all dairy herds and primarily of such as furnish milk for immediate use as sweet milk.

6th. If tuberculous cattle or other animals are found in a herd, have the remainder tested with tuberculin, and have all affected cattle appraised, killed, and, without delay or further expense, paid for by the State.

7th. Appraisers may be chosen one for the State and one for the owner, or better, to secure a more even handed justice, all alike should be valued by two State appraisers chosen for their knowledge of animals and their values, and for their integrity.

8th. Indemnities should be paid without delay on presentation of the affidavits of the stockowner, the inspector and the State appraisers.

9th. The precautions prescribed for private owners under the headings 9 to 15, and 18 should be carried out under the supervision of State officers.

10th. Disinfection of all contaminated premises and objects



should be done at State expense and by a special disinfecting corps under a trained, careful and thorough foreman.

11th. Attendants on cattle or other meat producing animals, who show any chronic disease of the air passages, lungs or bowels, should be examined for tuberculosis, by the municipal or town health officer, and their expectoration should be tested bacteriologically. If found to be tuberculous they must be forbidden to continue this occupation.

12th. Though herds have been tested and guaranteed sound, such guarantee must lapse as soon as new animals are introduced into them from public markets or untested herds. The guarantee may be preserved by having all such additions tested by tuberculin before they are added to the herd.

13th. In making tests with tuberculin the inspector will, as a rule, omit cases that are suffering acutely from other diseases or from advanced general tuberculosis, or that are approaching *oestrus* or parturition, such cases must be secluded and tested later when there is no such source of fallacy.

14th. All deaths in inspected and attested herds should be promptly reported to the government veterinary inspector of the district, who should make a careful post mortem examination and if he finds tuberculosis in even a latent form, the whole herd should be again tested with tuberculin.

#### DEFECTS OF THE EXISTING NEW YORK LAW.

New York is to be highly commended for taking an advanced position in the suppression of tuberculosis by process of law. It is to be regretted, however, that excellent intentions have been somewhat marred from a lack of acquaintance with the diseases of the lower animals, by those who have drawn and those who directed the administration of the law. It may not be altogether useless to name some of the more obvious defects in the law as hitherto in force.

##### A. THE PROVISION FOR TWO SEPARATE VETERINARY SANITARY BOARDS.

By existing law tuberculosis and glanders are dealt with by the State Board of Health, while all other diseases affecting the same

genera of animals are placed under the supervision of the Commissioner of Agriculture. The inspector under both central authorities ought to be a veterinary comparative pathologist acquainted with the whole range of animal diseases in order to deal with one—say tuberculosis—to the exclusion of other affections, and yet when he meets with another contagious disease he is helpless to do anything in the matter, and so are his superiors: application must be made to another department, which must send its own inspectors, though an entirely capable government employe is already on the ground, and an entirely new set of machinery must be set in motion to accomplish what could have been done far more promptly, effectively and cheaply by the inspector and bureau which were already in the field. Two bureaus with their officers and records are delegated to do work which naturally belongs in one, and delay, inefficiency and unnecessary outlay can be the only results of such an extraordinary distribution of functions.

#### B. DELAY IN KILLING THE DISEASED.

When an animal is condemned as tuberculous, it is not in the power of the inspector to at once suppress the danger, by seeing to the destruction of the beast; he must report to his superior in Albany and receive his order before he can go a step farther. The enforced delay hinders him from attending to other cases promptly and greatly enhances the cost of the work. By employing trustworthy inspectors only, allowing them to dispose of the sick and dangerous at once, and having their reports checked by the affidavits of the owners and appraisers, the work can be rendered far more effective and economical.

#### C. NO PROVISION FOR APPROVED APPRAISERS.

The law says the condemned animals shall be appraised, but fails to say how, and in the past the owner of the stock had to choose his own appraisers and the claims based on such appraisements naturally came up for liquidation under a cloud of discredit as having been made by men acting in the interest of the stockowner. No wonder that in some cases the loser of a tuberculous animal

found that the cost of establishing his claim amounted to more than the claim was worth. Two appraisers mutually chosen for State and stockowner, or still better, two honorable State appraisers who shall make affidavit to each estimate of value will do evener and more substantial justice to the owner of the stock, and the appraisement will come up for liquidation without the suspicion that attaches to such documents under the present system. If these are judiciously selected for skill and integrity, their awards, backed by the affidavits of the owner and inspector, will come to the disbursing officer with the best possible guarantee of their justice.

#### D. REFERENCE TO THE COURT OF CLAIMS.

By the present law every award for animals killed must be considered and allowed by the Court of Claims. The object is to secure justice, but it is manifest that the precaution begins too late. The Act leaves the owner to select his own appraisers, and unscrupulous persons may conspire to secure an excessive award in spite of the best efforts of the Court, who have never seen the animals valued, and can only act on the evidence furnished. The way is open therefore, for the unprincipled to prey on the State, while the man of principle correspondingly suffers. The remedy is to have appraisers, state officers and trustworthy men, in which case their decision will be at once more intelligent, fair, and equitable, than any revision that can possibly be made by a court sitting at a distance, however able and honorable its judges may be.

#### E. DELAY IN PAYING INDEMNITIES.

As a necessary consequence of the reference to the Court of Claims, much time is lost in preparing the case and in waiting the turn of the particular entry on the list. As a rule hearings have been had from nine to twelve months after the slaughter of the animals. This is no real advantage to the State which is saddled with the attendant Court expenses. It is often a serious matter to the stockowner, who is thus kept out of his source of livelihood, or has to borrow and pay interest on the money-value of the animals killed. Knowing the consequences of such delay, and that in



addition to this they must expend considerable money in preparing and presenting their claims before the Court, and in furnishing witnesses, many prefer to make no report of the disease to the authorities but to deal with it themselves. If men of high principle they personally bear all the losses, but if not, they too often send the diseased animals to market and thus provide for the starting of new centres of infection, or they slaughter them and sell the carcasses as human food. Thus the system of indemnification, surrounded, as it is by delays and uncertainties, becomes a means of spreading instead of restricting or extirpating the affection.

With the obvious safeguards of the affidavits of worthy men acting as inspectors and appraisers, for the State, and with the endorsement of their superior officer, payments could be made promptly, and the dread of serious loss would no longer deter stockowners from coöperating heartily with the State in the purifying of their herds. Relieve the owner of the present vexatious delays, of the legal and court expenses and the State will be furnished with a powerful lever for the work of suppressing the contagion.

#### F. NO PROVISION FOR EFFICIENT DISINFECTION.

The existing law provides no definite means for the disinfection of contaminated premises, and, therefore, this most essential duty is thrown upon the owner to accomplish at his own expense and too often in his own way. Yet the extreme measure of killing the infecting or diseased animal entails the imperative duty of thoroughly disinfecting the place where such animal has been. Without this the expropriation and killing is a comparatively futile procedure. In the hands of an inexperienced farmer the attempt at disinfection is far more likely to be insufficient than complete, and if imperfect all or much of the trouble and expense has been thrown away. In all veterinary sanitary work, looking toward the extinction of a contagion, the work must be of a very radical nature, and if it fails in this it may be looked on as practically a failure. Restriction of the disease there may be without this, but extinction, never. With mere restriction outlay for pre-

vention must go on forever; with extinction it will be brought to a final end.

To be effective, disinfection should be made the work of trained state officials. There is no more reason why this should be charged on the stock owner than that he should bear alone the money loss of his animals. Both are means of the extinction of the contagion with the one object of the public good.

#### G. NO PROVISION FOR SYSTEMATIC WORK.

The existing law fails to provide means for dealing with tuberculosis in all parts of the state, or to enjoin that the limited means provided shall be applied in a systematic manner upon any given area. Attention is therefore given to the herds whose owners make special application for inspection and those that are reported by others, and thus the inspectors are to-day in Westchester county, to-morrow in Erie, and the next in Tioga or Oswego. Single reported herds are dealt with and the great bulk of stock in the same district are passed over unnoticed. Is it to be wondered that complaints of partiality are heard? With the utterly inadequate appropriation this condition of things is perhaps inevitable, but it is certainly not the way to suppress the disease. A system that wipes out the disease on one farm, and at once leaves it to be reinfected, from a diseased herd on the next place perhaps, is anything but commendable. If the means can be afforded to deal with the disease over the entire state, let this be done; but if not then let the appropriation be applied to a given geographical district and let this be purified as a whole and held so, while the good work is extended to other regions.

#### INSUFFICIENT INDEMNITY A FALSE ECONOMY.

In conclusion, it is right to emphasize the importance of a due consideration of property rights. Sanitary laws which in any way ignore or disregard the rights of property have within themselves the seeds of defeat. If within our municipal abattoir the butcher cannot conduct his business as well and economically as in his own establishment, he or his competitors will evade the law in some way. If the stock owner is not fairly reimbursed for

his animals slaughtered and for other losses sustained for the protection of the public health and of the country's herds, unscrupulous men will find ample means of trading off the as yet incipient and occult cases of tuberculosis, and thereby planting the infection widely in new herds. Compensation must stop short of making the sanitary bureau a profitable customer for tuberculous animals at sound prices, but it must be so liberal as to enlist the ready coöperation of the stock owner in having every infected beast safely disposed of. Cases of advanced generalized tuberculosis may in all justice be listed at a low rate, as they are in every sense unfit to live, and are an expense, a danger and a nuisance even when dead. Cases too that have just been imported from another state or country and which are either manifestly diseased or taken from a tuberculous herd may fairly be excluded from indemnity and above all from a liberal indemnity. But in nearly every herd the majority of the stock condemned are to all outward appearances sound animals, and the owner has had no suspicion concerning them until this has been betrayed by the tuberculin test. But for that he would have gone on utilizing the animals in perfect good faith, and his customers would have received the dairy products in all confidence as to their wholesomeness. Had he wished to sell these animals for the dairy or for beef, he would have found plenty of purchasers at sound market rates. If the stock were thoroughbred and their progeny of a high prospective value he could have continued to breed from them for years since calves are rarely born tuberculous—not once in many thousand births even from tuberculous parents—and thus he might have largely profited by raising them on the milk of healthy cows. Then again in country districts the owner must bear the cost of disposing of the carcass by burning or burial in some place to which other animals do not have access. Further, the essential work of disinfecting the premises is at present put on the shoulders of the stockowner. Once more, if the stockowner is a dairyman, his trade is injured by the condemnation of animals in his herd. Customers will suddenly change to other dairies, creameries will be closed against his milk, and health officers are likely to quarantine the product, at least between the condemnation and slaughter. Apart from this his home supply



of milk is lessened and to keep his customers he must go into the market and buy milk from others.

It is quite evident that in many cases of dairy herds and of valuable thoroughbred animals, an indemnity amounting to even the sound market value of the animals killed comes far short of reimbursing the owner for his actual losses.

These considerations should be taken fully into account, before adopting any proposal to fix a maximum sum or rigid rule for estimating values. The wording of the present law "the actual value" is perhaps as good as any, only provision should be made to have able and incorruptible appraisers, and a restricting clause might be introduced to prohibit or minimize awards for animals recently introduced into the State.

Disinfection should as a rule be done by State employes, thus relieving the stockowner of the expense and securing effective results. The disposal of carcasses may also in many cases be justly charged on the State. This cannot be an entering wedge for corruption, as excessive indemnity would be, and yet it would relieve the stockowners of an outlay that should be met by the public at large.

The disposal of infected manure and other products must be under the direction of the inspector, but must evidently be undertaken by the stockowner himself.

Points like the above cannot be too strongly insisted on, as they determine success or failure. In the extinction of cattle lung-plague in the United States the strict attention to such accessories proved the main factors in the speedy success. In Cook Co., Ill., I took charge of the work on behalf of the United States Government in April, 1887, and in July we had done away with the last acute case of the disease. But the whole city was systematically purged, stable by stable, no communication between sick and healthy was possible, condemned cattle were quickly disposed of, and in two weeks each owner received from Washington a check for the amount of his indemnity: thorough disinfection was effected by a government corps so that no stable ever needed to be disinfected a second time, and effective measures were taken to prevent the introduction of new cattle from infected localities. No state was ever so speedily cleared of this

disease and the result must be altogether attributed to the carefulness of the methods, and their thorough application, and not least to fair indemnities and the promptitude of their payment. Great Britain has been struggling with the same disease for fifty years, and though she slaughters the sick, yet for lack of other efficient measures she cannot yet show a clean bill of health.







